# OUR PRESENT KNOWLEDGE OF CONTROL OF THE PEA APHID ON CANNERY PEAS IN THE EAST.

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## Results of Three Years' Study

For three successive seasons, those of 1924, 1925, and 1926, extensive experiments have been made in Wisconsin with various methods of control of the pea aphid on canners' peas. Much valuable information has been assembled on the possibilities and the limitations of the various methods tried for the control of this aphid. While no uniformly successful method has as yet been developed, it is felt that this summary of both the successes and the failures may be of interest to pea canners and growers and will assist them in deciding on the best course to follow in the light of our present knowledge of the pea aphid.

The pea aphid is the most serious insect pest of the pea-canning industry. Its ravages occur regularly in the principal pea-growing sections of the United States and there are periodical peaks of abundance when damage may be very great. The damage which the aphid actually does in different years is governed largely by weather conditions as they affect the growth of peas.

Although no consistently effective method for the control of the pea aphid under all conditions has been found up to the present time, the results obtained show that the aphid's damage may be greatly reduced, and the yield of shelled peas definitely increased, under certain climatic conditions. On the other hand, the necessity for its control under some seasonal conditions is shown to be doubtful.

Experiments have been made with the following varieties of peas: Alaska, Perfection, Advancer, Horsford, Rice 13, and Horal.

## Dusting and Spraying Have Limited Value

Three years' experiments with dusting and with spraying show that these methods are not effective in controlling the aphid - under Wisconsin conditions, at least. Many different dusts and spray materials were used. While a kill of 90 per cent was obtained in three tests, the usual result was only a 50 to 60 per cent kill.

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1/ This project is being carried on in cooperation with the Wisconsin Agricultural Experiment Station and others.

One-half acre of Alaskas dusted in 1924 with nicotine dust, on which a 79 per cent control was computed, gave the following results:

| | Yield per acre | Grade rate | Income per acre |
|---|---|---|---|
| Dusted plot- - - - - - - - - - | 1,703 lbs. | $3.68 | $62.86 |
| Untreated plot - - - - - - - - | 1,452 lbs. | 4.08 | 59.24 |

One-half acre of Horals dusted in 1926 with nicotine dust on which a 48 per cent control was computed, gave these results:

| | Yield per acre | Grade rate | Income per acre |
|---|---|---|---|
| Dusted plot- - - - - - - - - - | 1,768 lbs. | $4.92 | $ 86.99 |
| Untreated plot - - - - - - - - | 2,246 lbs. | 4.72 | 106.04 |

## Sweeping Gives Varying Results

In the face of unsatisfactory results from dusting and spraying, an attempt was made in 1924 to develop some other means of mechanical control which would be effective against the aphid and at the same time leave a profit for the grower. The development of the aphidozer or sweeping machine was the result.

It was realized that the yield and quality of peas should be determined for both treated and untreated fields, for it is important to know, not only the effect of treatments upon the aphid, but the effect of both treatments and aphids upon the resulting yield of shelled peas on the one hand and the quality of the canned product on the other.

### Excellent in 1924:

The season of 1924 was exceptional from the standpoint of weather conditions. A cold, dry spring continued well into July. The mean temperature for May, June, and July was well below normal and the rainfall until the middle of June was very low. These climatic conditions checked both the growth of peas and the development of aphids on two varieties swept, Advancer and Rice 13.

The vines were short, wiry, and late in blossoming. It was possible to sweep most of them before the appearance of blossoms or at least in the early blossoming stage. Soon after the peas had been swept, a period of warm, humid weather became most favorable for the development of the fungous enemy of the aphid and this disease quickly reduced the infestation to a negligible quantity, especially in fields which had been swept.

The results were unexpected. Briefly, they showed that of five fields swept, averaging 2 1/4 acres each, the yields in pounds of shelled peas per acre were increased over the yields of adjacent unswept plots by the following percentages: 57, 79, 20, 107, and 47, averaging 62. This meant an average of 62 per cent increase in yield due to sweeping.

The quality of canned peas was determined from special infested and uninfested plots, and, while the results were not decisive, the quality was usually better in the uninfested peas.

It should be emphasized that in 1924 the vines could not support a heavy population of aphids and still mature a crop; and that aphids disappeared from the fields soon after sweeping.

Adverse in 1925:

By 1925 it became apparent that, as additional data (the grade relative percentages of sizes of shelled peas) should be obtained, for it was evident that swept fields yielded a larger proportion of small peas to the total than did unswept fields. Therefore, the grades were ascertained when possible in all subsequent experiments.

The weather conditions during the growing season of 1925 were quite different from those in 1924, the temperature and rainfall being below normal in May and July and slightly above normal in June. May was the driest month on record at the Madison weather bureau and June one of the wettest. With high maximum temperature and abundant moisture in June, the vines developed an unusually heavy, rank growth, blossomed early, and matured early.

The aphids likewise were favored by these weather conditions and increased at a rate almost beyond belief, outstripping their natural enemies, especially the fungus, which did not become epidemic in 1925. The peas, although heavily infested, had a surplus of vitality sufficient to withstand the attack.

Extensive sweeping experiments were carried on with Alaskas and Advancers. All or parts of 14 fields were swept, some with no infestation, some with a heavy one, some before blossoming, some in blossom, and some in pod.

Results this year showed that in only two tests, a field of Alaskas uninfested and a field of Advancers heavily infested, did sweeping increase the gross yield. In the other 12 tests a loss was suffered. In two or three cases, to be sure, the poorer part of the field to be swept was chosen and so these results can not be used.

While the average yield was less for the swept than for the unswept plots, the grade rate was increased by sweeping, in 10 out of 13 fields, one grade rate not being available. The average grade rate for swept plots was $3.13 a hundred pounds, for unswept, $2.91--a difference of 22 cents a hundred in favor of sweeping.

The quality determinations from swept and unswept fields were gratifying. Experimental cannings were made from only two fields, one for each variety. Cans of every size pea from swept plots were of better quality than those from unswept plots.

The two essential points of the 1925 operations to remember are the rank, succulent pea vines; and the fact that aphids multiplied very rapidly, not being reduced by natural agencies until late in the season.

Mediocre in 1926:

A fertile, fairly uniform tract of land was obtained in 1926 upon

which to make more accurate tests. This was planted to 18 exact, separate acres of five varieties: Alaska, Perfection, Advancer, Horsford, and Horal. Four-foot paths surrounded each acre, entirely separating one plot from another, and enabling observers to study the growth of peas and multiplication of aphids with a minimum of injury to the vines. Some of the 18 acres were subsequently subdivided so that 25 plots finally resulted. Apparently every arrangement had been made for a successful summer's work. The subsequent scarcity of aphids, however, handicapped the control experiments.

The growing season of 1926 was favored with temperatures slightly above normal and an abundance of rainfall up to the middle of June. From this time on until the end of the canning period, it was relatively cool and dry.

The peas, responding to favorable weather conditions in the early growing season, grew fast and the vines became quite succulent although not so rank as in 1925. These same conditions would seem to be favorable for the rapid multiplication of the aphids, but because of some one factor or a combination of factors, they did not become numerous enough in the vicinity of Columbus, Wis., to justify control measures, considering the excellent condition of the vines. Nevertheless, as the stage was all set to obtain accurate data under uniform and well controlled conditions, sweeping was carried on with all five varieties under conditions such as heavy infestation (artificially infested), moderate infestation, sweeping before bloom, sweeping in full bloom, and sweeping in pod.

Ten plots were swept and one dusted. In most of the tests the sweeping was not justified by the number of aphids present, but it was done in order to find out the mechanical effect of the aphidozer upon the yield, grade rate, and quality of the peas. Three plots showed an increase in yield due to sweeping and seven showed a loss. On the other hand, seven plots showed an increase in grade rate due to sweeping and three showed a loss. The average grade rate for all treated plots was $3.90 per hundred pounds and for all untreated plots $3.64, a difference of 26 cents per hundred pounds in favor of sweeping.

The average yield per acre in shelled peas for all treated plots except the Horals was 2,156 pounds, while for all check plots except Horals it was 2,206, a difference of 50 pounds per acre in favor of the unswept plots. Although seven plots showed a decrease in total yield from sweeping, yet this difference was usually overcome by the increase in grade rate, making the gross income a plus instead of a minus for the swept plots. The average gross income per acre, therefore, of all treated plots except Horals was $77.00 and for all check plots except Horals, $73.87--a difference of $3.13 per acre in favor of sweeping.

The peas from 13 different plots, treated and untreated, were experimentally canned to determine the quality. There was practically no difference in the quality, as determined by F. A. Stare of the Columbus Canning Company, in any of the plots of the same variety, all sizes being of a high quality with some varieties entirely fancy throughout for all sizes, swept and unswept.

Two important points to remember in this year's experiments are the excellent growth of succulent vines and the absence of a dangerous infestation of the aphid.

## Seasonal Weather Conditions Determine Value of Sweeping

An analysis of the greatly differing results of the past three years obtained through the use of the aphidozer and concerned with total yield, grade rate, and quality, shows a closer relationship between aphid damage and weather conditions than between aphid damage and aphid abundance.

In 1924 the average yield of swept peas was increased by 62 per cent over that of untreated fields. From all observations and records, it is believed that this noticeable increase was due to the fact that pea vines were short and backward and could not support even a moderate infestation of aphids and at the same time produce a normal crop. Shortly following the use of the aphidozer, the fungous disease broke out and spread at an extremely rapid rate in both swept and unswept areas, but it appeared to spread much faster in the swept areas. Observations made not only at Columbus but at other points in the State, especially Valders and Oostburg in Sheboygan County, make it appear that the aphidozer brushes were ideal for spreading the fungus spores at a time when other conditions were at an optimum for their rapid multiplication. When such conditions as occurred in 1924 occur again, it is fully expected that similar increases in yield will be realized. The quality of canned peas was somewhat better from the swept fields. That no greater difference resulted may be due to the generally backward condition of all the vines.

In 1925 just the opposite conditions from those of the previous year were experienced. Vines were tall, rank, and succulent, capable of supporting a heavy population of aphids and at the same time producing enough sap to mature more than a normal crop of peas. On the other hand, the aphids were not noticeably reduced by the host of natural enemies and increased at an alarming rate on both swept and check plots. This year the aphidozer decidedly injured the rank, brittle vines; and hence the consistent reduction in yield, which now seems perfectly logical although at the time it could not be understood in the face of the opposite results of 1924. The heavy infestation, while having little apparent effect upon the total yield, reduced the quality of the canned product as shown by the canning tests.

In 1926 there was again experienced a heavy vine growth with plenty of vitality, but in this case a lack of aphids in damaging numbers. The aphidozer injured some varieties extensively, particularly those like Perfection and Horsford which tend to be succulent. Other varieties, such as the Alaskas, appeared not to be injured at all. Because of an increase in grade rate from the majority of swept plots, the net result of sweeping was a small profit. In the absence of a heavy infestation, the quality of the canned peas was not bettered by sweeping.

## Infestation Differs with Pea Varieties

Experiments have been carried on for two winters in the greenhouse to determine the rate at which aphids increase on different varieties. Results obtained to the present time indicate that the Alaska variety comes first in the number of aphids developing thereon. Likewise, the Horsford comes second, Advancer third, Horal fourth, Perfection fifth, Rice 13 sixth, and Yellow Admiral seventh. Although there may be some question as to the

exact place of the varieties in the middle, it is very clear that in the greenhouse aphids reproduce most rapidly on the Alaska and least rapidly on the Rice 13 and Yellow Admiral.

Field data for years previous to 1926, collected from miscellaneous hand sweepings throughout Wisconsin and other States, show that the Perfection, Advancer, and Alaska varieties come well up to the top in quantity of infestation, whereas the Rice 13 and Admiral varieties are well toward the bottom. In 1926 hundreds of sweepings in the field on five varieties--Alaska, Perfection, Advancer, Horsford, and Horal--showed the following: Up to the time the Alaskas were cut, they led in the number of aphids, with Advancers second and Horals third. Leaving out the Alaskas, the infestation on the other four varieties was greatest on the Advancers, next on the Horals, then on Perfection, and lastly on Horsfords, the quantity of infestation on each variety being separated by a wide margin.

## Effect of Vine Injury on Yield

Experiments were commenced in 1924 to find out the effect upon the yield of pruning or injuring pea vines. The purpose was to determine whether vines injured by the application of control measures could in any way come back and produce a normal crop. Small plots of seven varieties of peas have been carefully hand pruned and bruised in various ways for the past three years. Results were ascertained by pulling up the vines, counting and weighing the total pods, the mature, well-filled pods, the immature, misshapen pods, and the flat pods. Results to date have shown that, leaving out the Horal variety, five out of the other six varieties showed an increase in total number of pods and four out of the six an increase in the number of mature, well-filled pods due to various kinds of pruning. All six varieties showed an increase in weight of both total pods and mature, well-filled pods.

The Horal variety, however, showed a decided loss right through, in total pods, in mature, well-filled pods, and in the weight of each, due to pruning or bruising the vines early in the season.

## Recommendations

In the light of present knowledge, it is thought best to offer very conservative recommendations.

Horal peas probably are not going to stand up under mechanical control methods, especially sweeping.

The other varieties should not be swept or otherwise treated when the foliage is succulent, heavy, and of sufficient vitality to withstand an aphid infestation.

Vines in full bloom or in pod should not be swept until further data are gathered on the net result of sweeping under such conditions.

Until further experimental data have been obtained, sweeping should not be done if there is a decided question whether or not it is necessary.

On the other hand, sweeping may be depended upon to increase yields under conditions of a hot, dry season when pea vines are short and wiry and aphids occur in large numbers.